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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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June 1970

U.S. Training and Employment Service
Technical Report
S-45R

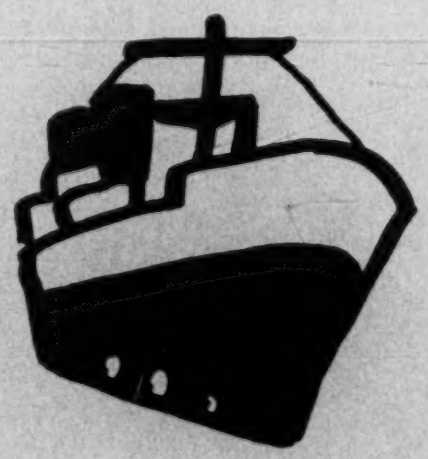
Development of USTES

APTITUDE TEST BATTERY FOR

SHIPFITTER

(ship & boat bldg. & rep.
806.381

U.S. DEPARTMENT OF LABOR
Manpower Administration



TM 001 243

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Shipfitter (ship & boat bldg. & rep.) 806.381

S-45R

(Developed in Cooperation with the
Pennsylvania State Employment Service)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2003

Development of USTES Aptitude Test Battery

For

Shipfitter (ship & boat bldg. & rep.) 806.381-042

S-45R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Shipfitter (ship & boat bldg. & rep.) 806.381-042. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	105
P - Form Perception	75
M - Manual Dexterity	85

Research Summary

Sample:

62 male workers employed as Shipfitters in Pennsylvania.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi coefficient = .47 ($P/2 < .0005$)

Effectiveness of Norms:

Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 85% would have been good workers. Thirty-four percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 15% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	66%	85%
Poor Workers	34%	15%

SAMPLE DESCRIPTION

Size:

N = 62

Occupational Status:

Employed workers.

Work Setting:

Workers were employed by the Philadelphia Navy Yard, Philadelphia, Pennsylvania.

Employer Selection Requirements:

Age: Non-veterans must be under 22 years of age. There is no age limit for veterans.

Education: None required.

Previous Experience: None required.

Tests: Civil Service Examination.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least ten months job experience.

TABLE 2

Means (M), Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience.

	Mean	SD	Range	r
Age (years)	34.4	3.5	28-44	-.020
Education (years)	11.4	1.4	8-15	.051
Experience (months)	96.4	29.5	10-154	.166

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered in April, 1953.

CRITERION

Combined rank order supervisory ratings were used as the criterion for this study. Ratings were prepared by a Quarterman and three Leadingmen. The Leadingmen are working group leaders and the Quarterman is a foreman who exercises supervision over several groups. The Quarterman represents essentially second line supervision and the Leadingman first line supervision, although in this situation second line supervision is still very close to the actual work.

The Quarterman rated 61 individuals, and the three Leadingmen rated 50, 28, and 30. Each individual in the sample was rated at least twice. These ratings were converted to linear scores and the linear scores for each man were added together and averaged. The mean linear score for each worker was used as his criterion score.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 34% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 43.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes P and M which do not have high correlations with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that these aptitudes were of critical importance for the job duties. Aptitude V which does not have a high correlation with the criterion qualified for inclusion in the trial norms since the sample had a high mean and low standard deviation for this aptitude. Tables 3,4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required in all phases of the work requiring decision and judgment.
N - Numerical Aptitude	Required in making numerical calculations and in laying out geometric patterns.
S - Spatial Aptitude	Required in working with blueprints, and in layout and assembly work.
P - Form Perception	Required in inspecting assembly and completed work.
M - Manual Dexterity	Required in handling tools and equipment.

TABLE 4

Means (M), Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N =62.

	Mean	SD	Range	r
G-General Learning Ability	113.6	13.2	72-139	.263*
V-Verbal Aptitude	109.9	13.9	74-131	.014
N-Numerical Aptitude	106.8	14.1	69-141	.088
S-Spatial Aptitude	113.6	18.1	58-146	.501**
P-Form Perception	99.1	14.7	54-138	.179
Q-Clerical Perception	108.0	12.8	76-138	-.076
K-Motor Coordination	103.2	12.4	72-132	.003
F-Finger Dexterity	96.1	15.4	64-139	.152
M-Manual Dexterity	106.0	17.9	72-149	.134

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X*				X*
Irrelevant									
Relatively High Mean	X	X		X					
Relatively Low Standard Dev.	X	X				X	X		
Significant Correlation With Criterion	X			X					
Aptitudes to be Considered for Trial Norms	G	V		S	P*				M*

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, S, P and M at trial cutting scores were able to differentiate between the 66% of the sample considered to be good workers and the 34% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Norms of S-105, P-75 and M-85 provided optimum differentiation for the occupation of Shipfitter (ship & boat bldg. & rep.) 806 381-042. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .47 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
S-105, P-75, and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	33	41
Poor Workers	15	6	21
Total	23	39	62

Phi coefficient = .47 Chi square (X^2_y) = 13.9

Significance level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-34 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .24 is obtained with the OAP-34 norms of N-90, S-95, and P-90.

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FACT SHEET

Job Title:

Shipfitter (ship & boat bldg. & rep.) 806.381-042

Job Summary:

Lays out, fabricates, assembles, installs, repairs, and dismantles structural metal parts of ships and other miscellaneous assemblies, using a variety of hand and power tools and machines for bending rolling, shaping, and shearing structural metal.

Work Performed:

1. Lays out Lines, and Markings on Steel Shapes and Plates: (Shop) Working from blueprints, sketches, mold loft templates or oral instructions, lays out shell plates, deck plates, bulkhead plates, gun rings, foundations, struts, skegs, framing, rudder weldment "I" beams and a variety of other structural parts. Selects type of metal to use. Positions pieces on layout table using electric hoist or services of riggers, checking length and width of pieces withblueprint dimensions. Marks along outline of template with soapstone, scratch awl, center punch and hammer to transfer reference points and working lines -- such as water lines, buttock lines, center lines and forming directions required by fabrication workers for cutting, shaping, bending, punching, drilling and other operations. Reading off template, marks on the plate with a brush and white paint all essential data necessary for fabrication, assembly and installation such as plan number, job order number, lot number, amount of pieces made, drilling and welding instruction, water lines, buttock lines. Lays out geometric patterns by measuring and marking out points and outlines directly on metal plate using such measuring instruments and layout tools as Trammel points, dividers, rule, tape and center punch. Requests Riggers to move heavy material to proper machine for fabrication. Lays out small structural parts such as brackets, Butt Straps, floor plates and and face plates, using shipfitters tools and punching, shearing, mitering machines.

2. Plans, lays out and directs assembly of Fabricated Steel Shapes: (Shop)

Assembles fabricated shapes, plates, bulkheads, decks, frames, bow and stern sections, masts, rudders, (Ships Fair Waters), rudder weldment, doors, ladders, Hawse pipes, Sea Chests, pipe assemblies and many other parts; working from blueprints, sketches, mold loft templates or oral instruction. Fits and directs the preassembly of parts using marking and layout tools, carpenter's squares spirit level and straightedge to establish a set of convenient working lines such as buttock lines and frame lines. Indicates to tack welders where to tack clips to fasten assembly in preparation for final welding or riveting. Constantly checks assembly with blueprint or mold loft template, using plumb bob and spirit level. Establishes final marks on parts and directs Gas

Cutter and Burner, or Calker and Chipper in trimming parts during preparation of assembly for final welding. Inspects assembly and marks with chalk any minor alterations to be made by chippers and burner. Gives instructions to welders or riveters for final welding or riveting, indicating type and size of welds or rivets to be used. Checks final assembly to determine whether it meets all specifications for size, shapes, welding, riveting and fitting.

3. Installation or Erection: (Shipboard) - Working from blueprints and following a predetermined sequence of erection installs and fits structural preassemblies or units and non-structural parts and equipment on ship. Assembles and erects bulkheads, deck houses foundations, masts, Longitudinals, frames. trunks, bow and stern sections, Collars, brackets, doors, fairwaters, hawse and other parts. Assists and directs riggers when having assemblies or units set into proper position. Adjusts and moves the structural members into alignment with marked lines using jacks, turnbuckles, wedges, Mauls and other tools. Designates to tack welder where to tack weld for more secure fastening. Marks minor alterations to be made by chipper and burner to fair up the assembly. Directs drillers, riveters and welders in final assembly indicating where holes are to be made for drilling, type and size of rivet for riveting, type and size of weld to be used in welding. Inspects completed work of welders, drillers, and riveters to insure a tight fitting and compliance with specifications. Established Targets and working lines for laying out final cuts for propulsion equipment, sea chests, stern chests, struts, and other structures.

   Directs the installation of shell plating or welded or riveted construction, locates and aligns members and directs operations required to trim parts and obtain accurate fit.

   Dismantles, repairs and rebuilds damaged hull sections and other parts and assemblies on the ship. Directs the work of removing damaged sections, parts and assemblies.

   Fabricates, assembles, tests and repairs watertight doors, hatches, and Airports. Fabricates and assembles parts, working from templates.

   Occasionally makes templates directly from shipboard measurements where the exact dimensions and contours cannot be predetermined by the template makers, by fastening wooden strips to the members surrounding the area for which the template is to be made, marking the shape of the piece on the wood and recording fabrication and installation instructions on the template.

Effectiveness of Norms

Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-45R norms, 85% would have been good workers. Thirty-four percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-45R norms, only 15% would have been poor workers.

Applicability of S-45R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

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